(12) UK Patent Application (19) GB (11) 2 032 555 A

(21) Application No 7922944
(22) Date of filing 2 Jul 1979
(23) Claims filed 2 Jul 1979
(30) Priority data
(31) 78/42169
(32) 27 Oct 1978
(33) United Kingdom (GB)
(43) Application published
8 May 1980
(51) INT CL³
F16L 19/06
(52) Domestic classification
F2G 22C
(56) Documents cited
GB 1530205
GB 1522203
GB 1509179
GB 1233372
GB 1233371
GB 1098084
(58) Field of search
F2G
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Limited

(54) An improved means for effecting a friction coupling between inner and outer, relatively axially movable members

(57) The invention provides a friction coupling, e.g. between a pipe (4) and a collar or nut (1) surrounding the same, in which a force-applying ring (2) acts on a sleeve (3) by means of abutted frusto-conical surfaces of which that on the axially elongated sleeve (3) is between differently-shaped end portions, the sleeve (3) being so shaped that the clamping force it exerts on the inner member or pipe (4) is substantially uniformly distributed along the length of the sleeve (3).

The sleeve (3) may have a detachable, resilient nose portion (5) for sealing engagement with a member (6) screw-threadedly engaged by the collar or nut (2).

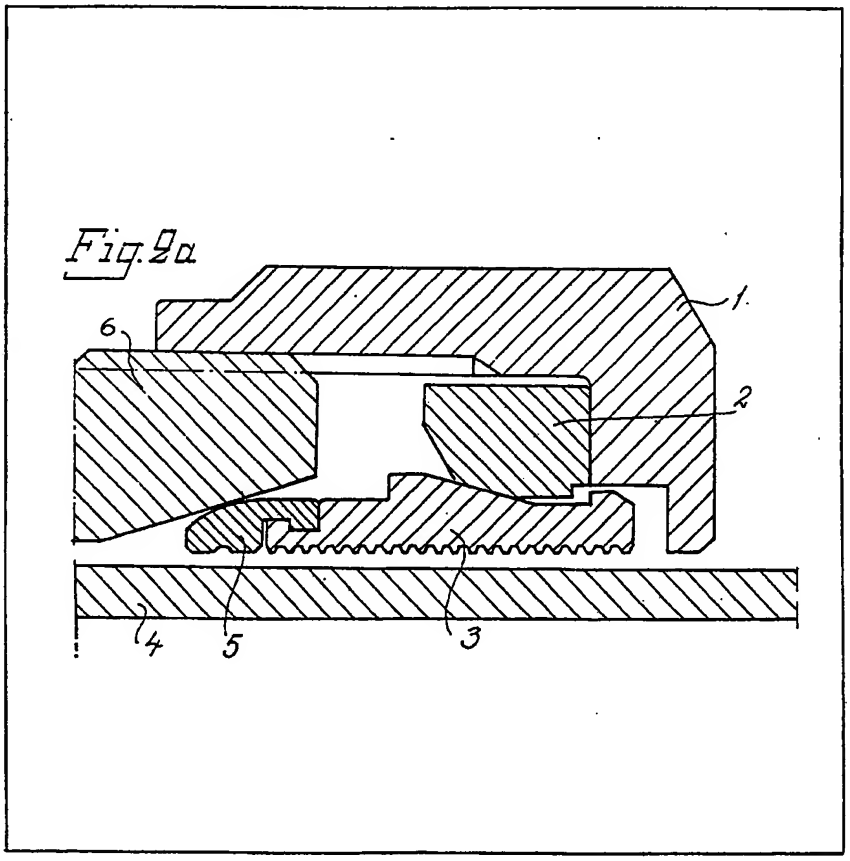

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Fig. 1

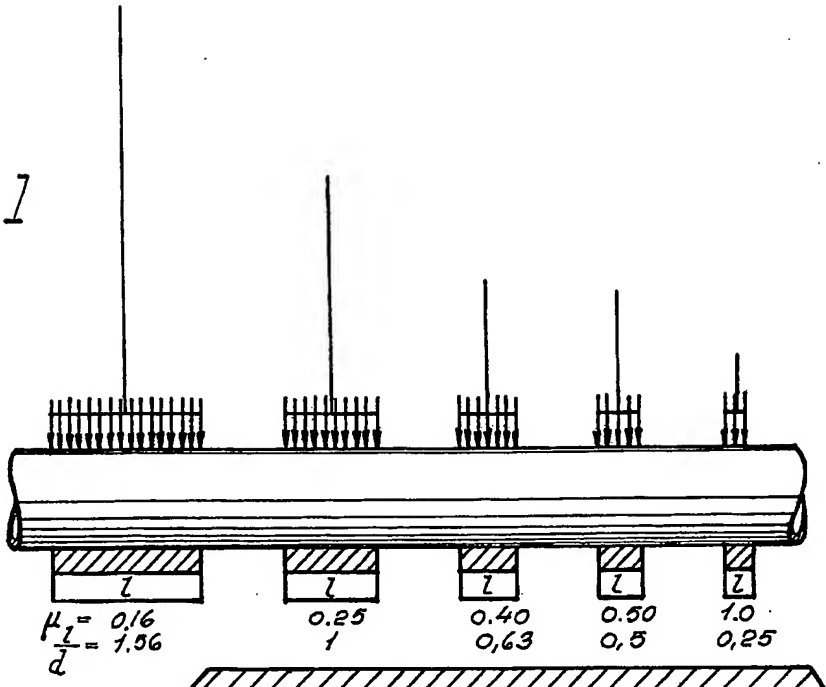

Fig. 4

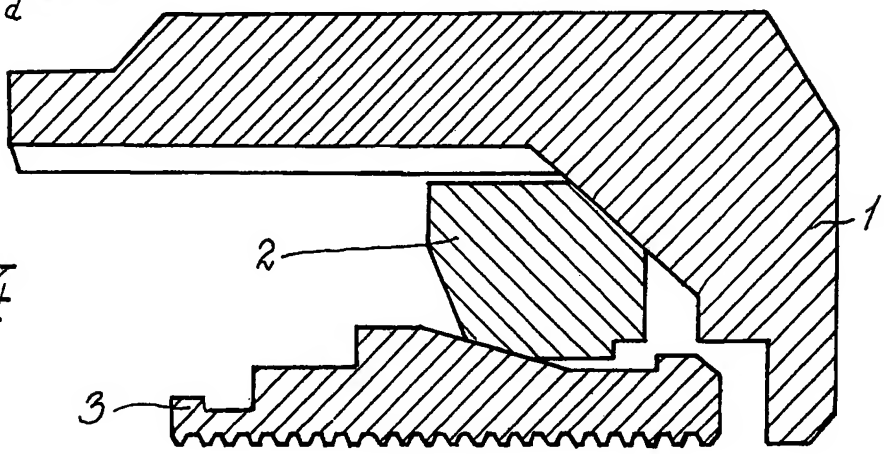

Fig. 5

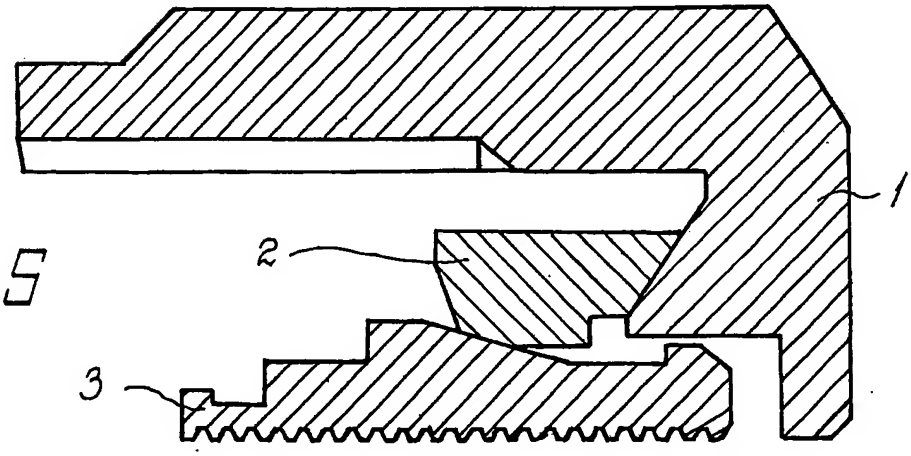

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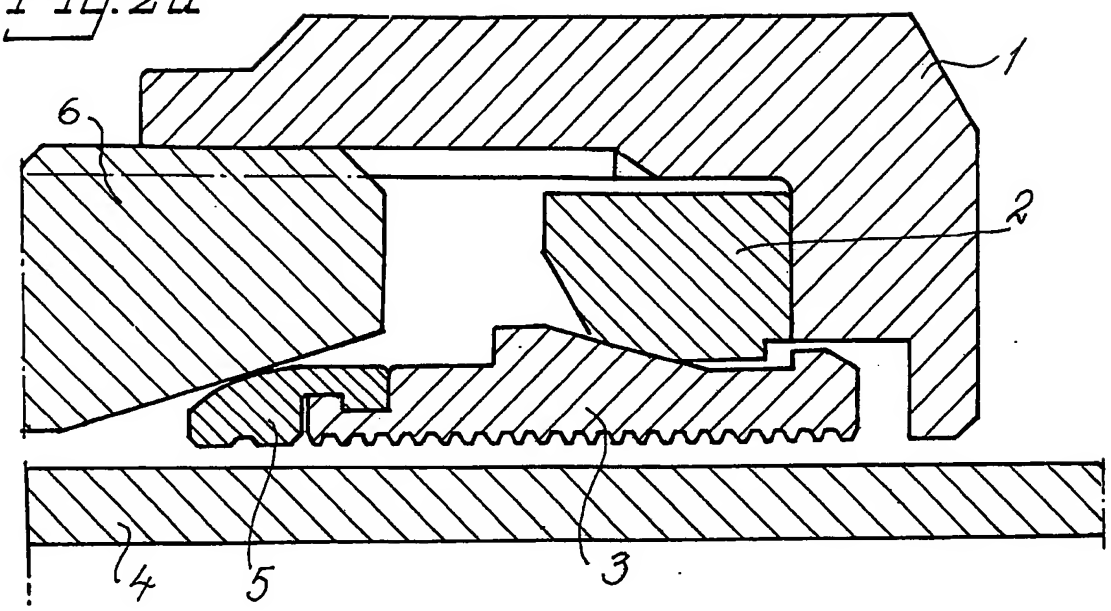
Fig. 2a



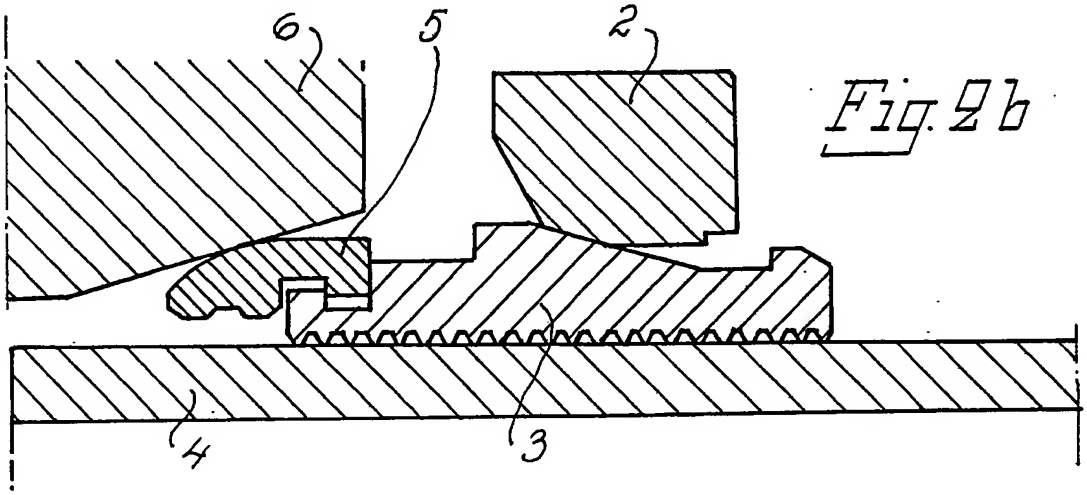


Fig. 2b

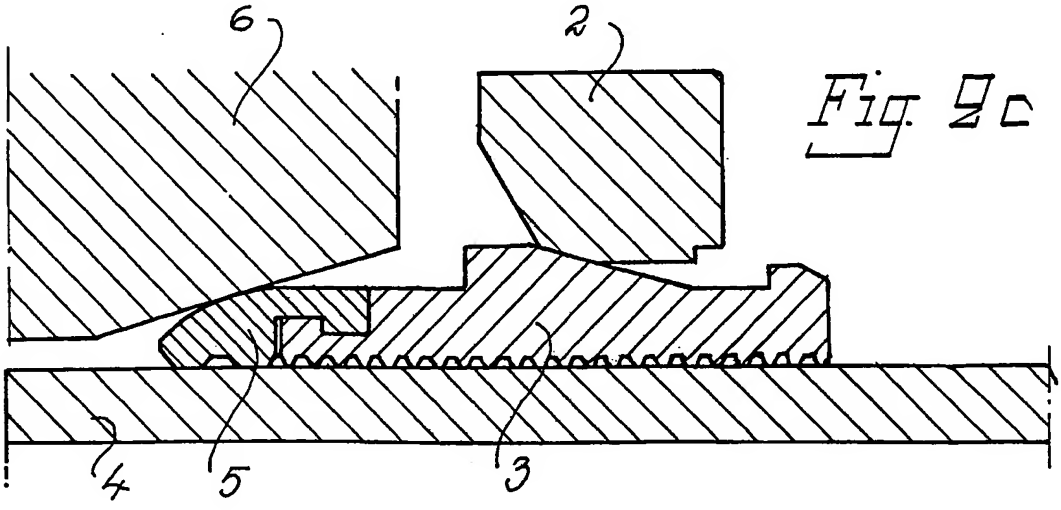
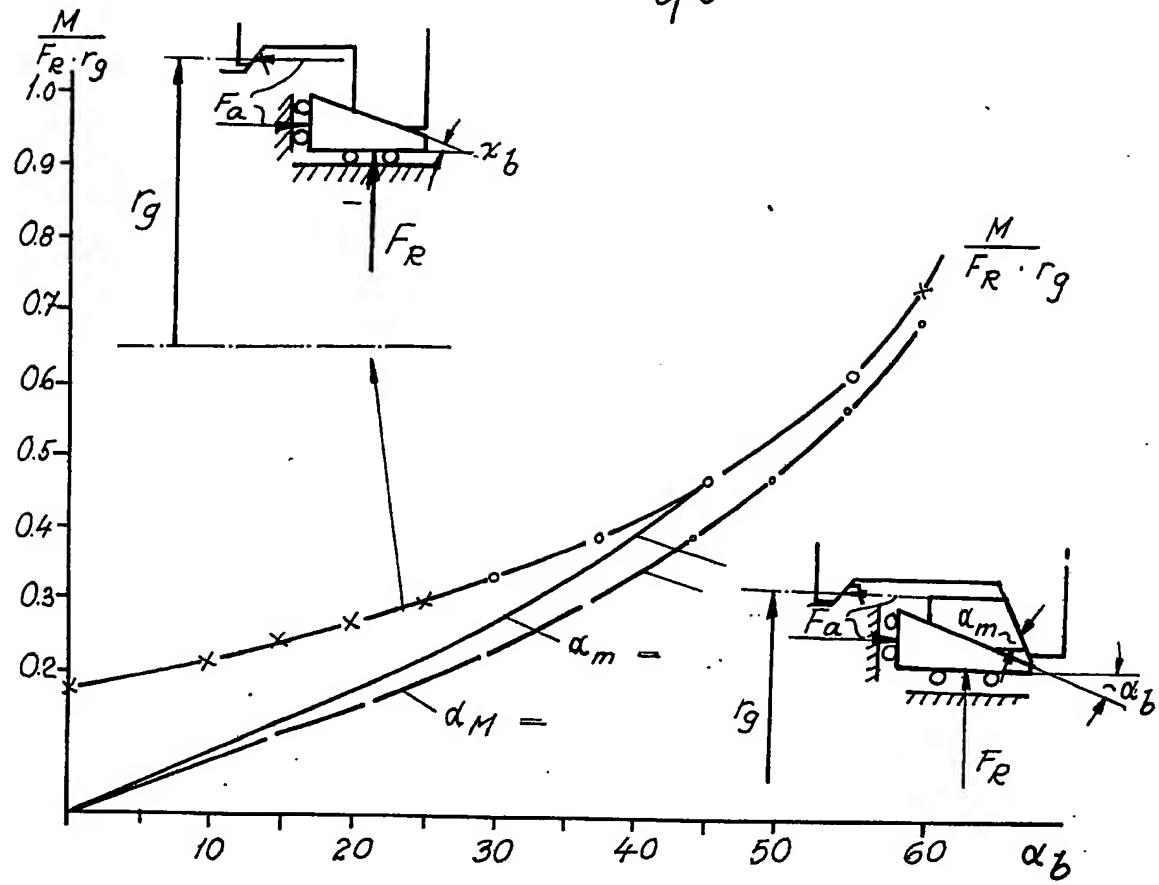


Fig. 2c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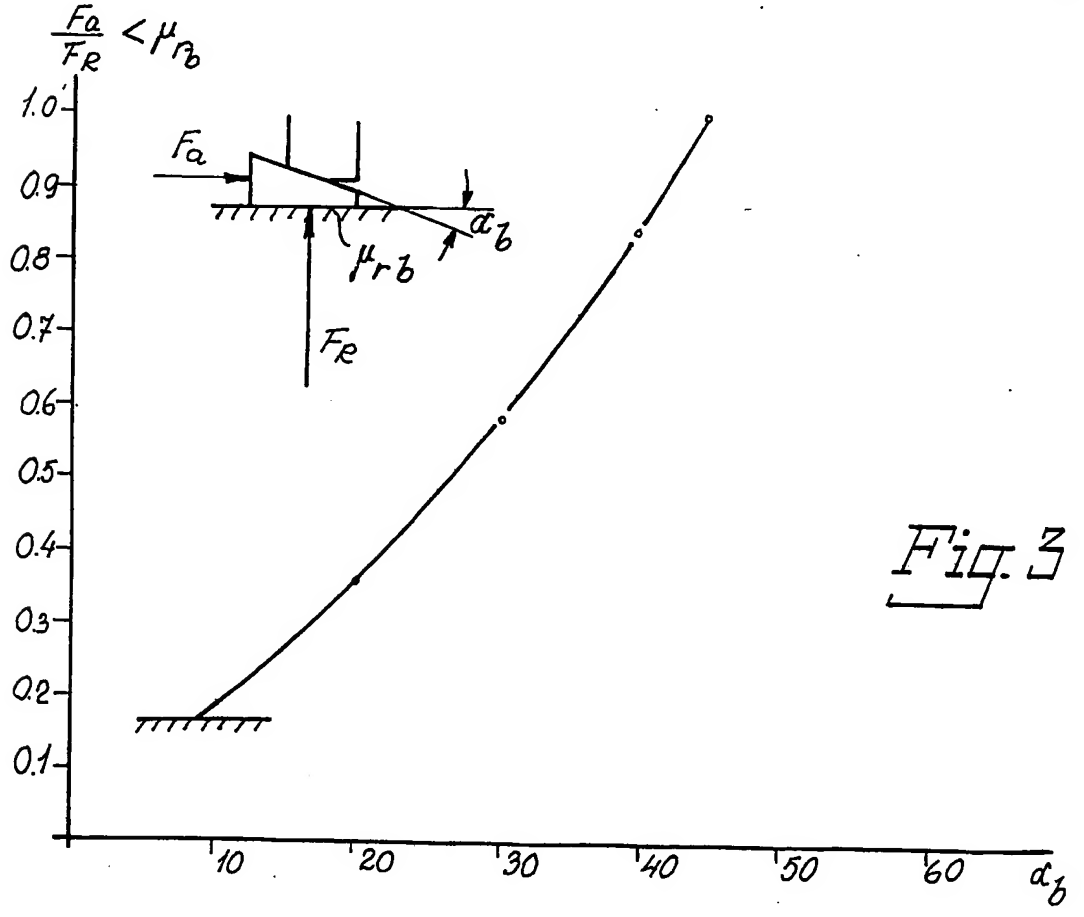
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Fig. 3

SPECIFICATION

An improved means for effecting a friction coupling between inner and outer, relatively axially movable members

This invention relates to improved means for effecting a friction coupling between inner and outer, relatively axially movable members, such as a pipe, rod or wire and a collar or nut surrounding the same.

Previously known couplings have been of the permanent kind, involving welding or brazing, and of the releasable kind.

The permanent kind have the obvious disadvantage that it is difficult to release the connection without damage, but even the releasable kinds of couplings hitherto available have the drawback that the joined members tend tobe deformed by the elements of the coupling, and this not only detracts from the performance of the coupled members but makes repeated assembly and disassembly impracticable.

An object of the present invention is to improve upon the type of coupling disclosed in Patent Specification No. 1,416,911 by dispensing with a twistable or tiltable spring ring without detriment to the desired force transmission.

U.S.A. Patent Specification No. 2,640,716 discloses a coupling in which a ring acts on a sleeve by means of co-operating frusto-conical surfaces. In this arrangement, however, the tube embraced by the sleeve is deformed in making the joint, with the disadvantages previously discussed.

A further object of the invention is to provide a coupling in which a twistable or tiltable spring ring is dispensed with but nevertheless an adequate holding force is applied to the inner member in such a way that it is not thereby deformed.

According to the present invention there is provided means for effecting a friction coupling between inner and outer, relatively axially movable members of which the outer surrounds the inner, said means comprising an axially elongated sleeve to surround the inner member with the sleeve in contact with the inner member at positions throughout the length of the sleeve, and a force-applying element movable with the outer member so that a frusto-conical inner peripheral portion of the force-applying element engages a frusto-conical portion of the outer periphery of the sleeve intermediate differently shaped end portions of the latter to apply to the inner member *via* the sleeve a clamping force substantially uniform at positions spaced along the sleeve.

The sleeve is preferably longitudinally slotted. Preferably the sleeve is thickened in the region of the frusto-conical surface portion thereof which will be engaged by the force-applying element and is so designed and constructed as to be resistant to deformation by the force-applying element.

The force-applying element may be a discrete annulus the axial end face of which further from its frusto-conical inner peripheral portion is abutted, in use, by a shoulder projecting radially inwardly of the outer member, the said end face and shoulder being similarly inclined relative to a common axis along which the inner and outer members are relatively movable. The inclination of said end face and shoulder relative to said axis may be in excess of 45°.

The said outer member may be in screw-threaded engagement with a third member which also surrounds the inner member, the third member having a frusto-conical inner peripheral portion arranged to be sealingly engaged by an annular nose portion detachably connected to one axial end of the sleeve. The nose portion may be resilient and may be adapted to be compressed into sealing engagement with the inner member when acted upon by the third member.

The inner periphery of the nose portion arranged to contact the inner member may be grooved to provide at least two axially spaced, annular ribs.

Preferred embodiments of the invention will now be described with reference to the accompanying drawings, in which:—

Figure 1 is a diagram illustrating different relationships between friction coefficient and applied force to obtain a given degree of grip,

Figure 2*a* is a longitudinal sectional elevation in a radial plane of a coupling in accordance with the invention, with the parts shown loosely assembled but prior to tightening up,

Figure 2*b* is a view similar to Figure 2*a*, but with the outer member omitted, showing the relationship of the parts when the coupling is partly but not fully tightened,

Figure 2*c* is a view similar to Figure 2*b* showing the relationship of the parts in the fully tightened condition of the coupling,

Figure 3 presents two diagrams showing the relationship between different angles chosen for the co-operating frusto-conical surfaces of the coupling and resulting torque, and

Figures 4 and 5 are views similar to Figure 2*a*, but with parts omitted, respectively illustrating two other embodiments of the invention.

Figure 1 shows the relationship between friction coefficient and applied force to achieve a predetermined grip. It can be seen that with a friction coefficient in the region of 1.0, which in practice provides a satisfactory mechanical connection, the necessary force to prevent slip is relatively small. By increasing the area of contact and by maintaining the same gripping force per unit of surface area the same grip can be achieved with a friction coefficient less than 0.2. Obviously the total applied force indicated in the Figure by a vertical line would be considerably increased.

The present invention is based on the fact that friction attachment can be achieved with a relatively small friction coefficient, provided that the necessary force can be applied.

For this purpose, a force-applying element 2 is utilised, arranged to transform the linear movement of a member 1, e.g. a collar or nut, to a sleeve 3, which is arranged to embrace and grip the peripheral surface of an inner member 4, such as a pipe. The sleeve 3 is axially elongated and is

preferably longitudinally slotted. Intermediate axial end portions of different shape its outer periphery has a frusto-conical surface in a thickened central region of the sleeve.

As shown in Figures 2*a* to 2*c*, the force applying ring 2 can be manufactured as a discrete component having an axial end face for abutment with a shoulder of the nut 1 lying generally perpendicularly to the axis of the pipe 4. The ring 2 further has a frusto-conical inner peripheral portion of limited axial extent arranged to contact the frusto-conical surface of the sleeve 3.

In the embodiment illustrated in Figures 2*a* to 2*c* the sleeve 3 is detachably connected with an annular nose portion 5, intended to provide a seal, but is will be appreciated that the nose portion 5 can alternatively be an integral part of the sleeve 3.

As shown in Figure 2*a*, the surface of the sleeve in contact with the pipe 4 has grooves whereby the grip is improved, but such grooves are not necessary in all cases.

The nut 1 screw-threadedly engages a third member 6 surrounding the pipe 4, and by rotating the nut an axial movement is produced which applies a clamping force to the sleeve 3 *via* the ring 2, which is slightly moved axially along the frusto-conical surface of the sleeve 3. The sleeve 3, which is designed according to stress calculations for a sleeve having a force applied at a predetermined point (see Figure 3), is thus made subject to a force acting in one plane intermediate its ends and perpendicular to its axis, said applied force causing the sleeve 3 to grip the pipe 4, the applied force being equally distributed per unit of contact surface area against the pipe 4 (see Figure 1). The desired large contact surface with an equally distributed applied force has thus been achieved.

As shown in Figure 3, the ring 2, which transforms the axial movement of the nut 1 into a radially acting force will reduce the necessary torque while achieving the desired grip.

If the sleeve 3 is longitudinally slotted improved contact is achieved.

When not only gripping but also sealing is required of the coupling, e.g. when two tubes are to be joined, a nose element 5 is advantageously joined to one end of the sleeve 3 as previously described. Said nose element 5 is annular and has a convex free axial end arranged to co-operate with a frusto-conical internal surface of the third member 6 to which the nut 1 is screw threaded. To provide a good seal the nose portion 5 is preferably resilient, so that its material is compressed between the member 6 and the pipe 4.

In order to obtain an improved radial guidance of the ring 2 it advantageously has a frusto-conical contact surface for the nut 1, which has a correspondingly frusto-conical shoulder surface. Two examples of such a design are shown in Figures 4 and 5; By utilising a suitable angle, preferably exceeding 45°, from the axis of the pipe 4, a small torque for applying the clamping force is maintained, and guidance is considerably improved.

In the embodiments having a sealing nose portion 5, the surface contacting the pipe 4 is advantageously shaped as a combination of convex and concave faces, preferably defining two axially spaced annular ribs separated by an annular groove.

It should be emphasised, that the ring 2 according to the present invention makes it possible to apply a clamping force equivalent to that achieved by previously known twistable or tiltable spring rings.

CLAIMS

1. Means for effecting a friction coupling between inner and outer, relatively axially movable members of which the outer surrounds the inner, said means comprising an axially elongated sleeve to surround the inner member with the sleeve in contact with the inner member at positions throughout the length of the sleeve, and a force-applying element movable with the outer member so that a frusto-conical inner peripheral portion of the force-applying element engages a frusto-conical portion of the outer periphery of the sleeve intermediate differently shaped end portions of the latter to apply to the inner member *via* the sleeve a clamping force substantially uniform at positions spaced along the sleeve.

2. Means as claimed in claim 1, wherein the sleeve is longitudinally slotted.

3. Means as claimed in claim 1 or claim 2, wherein the sleeve is thickened in the region of the frusto-conical surface portion thereof which will be engaged by the force-applying element and is so designed and constructed as to be resistant to deformation by the force-applying element.

4. Means as claimed in any preceding claim, wherein the force-applying element is a discrete annulus the axial end face of which further from its frusto-conical inner peripheral portions is abutted, in use, by a shoulder projecting radially inwardly of the outer member, the said end face and shoulder being similarly inclined relative to a common axis along which the inner and outer members are relatively movable.

5. Means as claimed in claim 4, wherein the inclination of said end face and shoulder relative to said axis is in excess of 45°.

6. Means as claimed in any preceding claim, wherein the said outer member is in screw-threaded engagement with a third member which also surrounds the inner member, the third member having a frusto-conical inner peripheral portion arranged to be sealingly engaged by an annular nose portion detachably connected to one axial end of the sleeve.

7. Means as claimed in claim 6, wherein the nose portion is resilient and is adapted to be compressed into sealing engagement with the inner member when acted upon by the third member.

8. Means as claimed in claim 6 or claim 7, wherein the inner periphery of the nose portion

arranged to contact the inner member is grooved to provide at least two axially spaced, annular ribs.

9. Means effecting a friction coupling between inner and outer, relatively axially movable members constructed and arranged substantially as herein described and as shown in Figures 2*a*—2*c*, Figure 4 or Figure 5 of the accompanying drawings.

Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1980. Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.